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Monday, May 23rd, 1853.

THOMAS ROMNEY ROBINSON, D. D., President, in the Chair.

Sir William Betham read a letter from W. D. Haggard, Esq., accompanying two thin discs of silver, used for overlaying modern forgeries of Spanish dollars, in illustration of the forgeries of the old Scottish coins exhibited to the Academy by Dr. A. Smith (see Proceedings, vol. v. p. 324).

Rev. Professor Jellett read a paper on the properties of inextensible surfaces.

Adopting Gauss's definition of an inextensible surface, namely, "A surface in which the length of any curve arbitrarily traced upon it is invariable," the author has proceeded to consider the conditions which the displacements of the several points of any such surface must fulfil. Denoting by x, y, z, the co-ordinates of any point on the surface, and by δx, δy, δz, the displacements of this point parallel respectively to the three axes of co-ordinates, he finds that these quantities are connected by a system of three partial differential equations of the first order, and of a very simple form. He finds also, that any one of these displacements may be determined by a single partial differential equation of the second order. Some interesting results follow at once from these general equations. Thus, for example, it is easily shown that if the displacements be all parallel to the same plane, the surface will move as a rigid body.

Having established these fundamental equations, the author has proceeded to deduce general expressions for the variations which the differential coefficients

$$\frac{dz}{dx}, \frac{dz}{dy}, \frac{d^2z}{dx^2}, \frac{d^2z}{dxdy}, \frac{d^2z}{dy^2},$$

undergo in consequence of the displacement of the surface. From these expressions Gauss's celebrated theorem as to the product of the principal radii of curvature follows at once.

The author has next proceeded to consider the effect of *fixing* any curve, or portion of a curve, upon the surface. In this investigation it is necessary to consider severally the three classes into which surfaces are divided with respect to their curvature, namely—

1. Oval surfaces, or those in which the principal curvatures have the same sign.

2. Developable surfaces, in which one of the principal curvatures vanishes.

3. Concavo-convex surfaces, in which the principal curvatures have opposite signs.

The author has obtained the following remarkable results:

1. OVAL SURFACES.

If a curve, or portion of a curve, traced upon an oval surface composed of an inextensible membrane, be rendered immovable, the entire surface becomes immovable also.

2. DEVELOPABLE SURFACES.

I. *If an arc of a curve (which is neither the* arête de rebroussement, *nor one of the rectilinear generatrices) traced upon a developable surface, be rendered immovable, all that part of the surface which lies between the rectilinear generatrices, drawn through the extreme points of the fixed curve, and on the same side of the* arête de rebroussement *with the fixed curve, will become immovable also. Beyond these limits the surface will have the power of motion.*

II. *The* arête de rebroussement, *or a rectilinear generatrix, may in general be fixed without rendering any finite part of the surface immovable.*

III. *The rectilinear generatrices of a developable inextensible surface are rigid.*

3. CONCAVO-CONVEX SURFACES.

In surfaces of this class there exist (as is well known) at each point of the surface two directions, such that the normal sections which pass through them respectively have at that point infinite radii of curvature. We may, therefore, conceive the entire surface to be crossed by two series of curves, such that if at any point a tangent be drawn to either of the curves which pass through it, the normal section passing through this tangent will have at that point an infinite radius of curvature. These curves we shall denominate (for a reason which will appear subsequently) *curves of flexure*. Preserving this definition, we shall have the following theorems:

I. *If an arc of a curve (which is not a curve of flexure), traced upon an inextensible surface of the third class, be rendered immovable, and if we conceive the two curves of flexure corresponding to the extreme points of the fixed arc to be drawn, the whole of the quadrilateral formed by these four curves will become immovable also.* (In forming this quadrilateral it is to be remembered that each of its angular points is formed by the intersection of two curves belonging to *different* series.)

II. *A curve of flexure may be fixed, without rendering any finite portion of the surface immovable.*

III. *If two arcs of curves of flexure, commencing from the same point, be fixed, the immovable portion of the surface will be the quadrilateral formed by these two arcs, and the two other curves of flexure drawn through their other extremities.*

The preceding theorem (II.) gives the reason for the name "curves of flexure." In fact, we see that if one of these curves be fixed, the surface has the power of *bending* round it. This would be impossible with any other curve.

The author has next proceeded to consider the case of surfaces which may be denominated *partially extensible*. These surfaces have at each of their points one or more inextensible directions. In other words, it is possible to draw through each point of the surface one or more inextensible curves. Respecting these surfaces, the author has arrived at the following results:

I. *Any surface may* (without being wholly inextensible) *have at each point one or two inextensible directions.*

II. *If a surface have at each point three or more inextensible directions, the surface is wholly inextensible.*

III. *If the curves of flexure be inextensible, the extension of an indefinitely small arc of a curve, divided by the arc itself, will at each point, and for a given law of displacement, vary inversely as the radius of curvature of the normal section passing through the tangent to the curve.*

Professor Allman read a paper on the structure of hydra.

The substance of *hydra* consists of two perfectly distinct strata,—an external, which may be called the *ectoderm;* and an internal, to which the name of *endoderm* may be given. The ectoderm is composed of cells of a more or less spherical figure; the greater number of these cells possess the power of developing, in their interior, *thread-cells.* Only one thread-cell is generally developed in each cell of the ectoderm.

The endoderm is composed of elongated pyriform or clavate cells, with their long axes perpendicular to the surface, and developing free, spherical, distinctly nucleated cells within them; several of these free cells being developed in each cell of the endoderm. Of the free cells thus developed in the interior of the endodermal cells, some are filled with colourless and transparent contents, while others contain a deep-brown granular matter. In this structure we cannot avoid recognising a true glandular system; the free cells being true secreting cells developed in the interior of mother-cells, and producing, by a process of genuine secretion, the brown granular matter, which may be viewed as representing the biliary secretion of the higher animals.

The endoderm and ectoderm are closely united to one another immediately round the mouth; in other parts of the body they are very easily separable. The cavity of each tentacle is